BROWNEOPSIS PUYENSIS (LEGUMINOSAE: CAESALPINIOIDEAE: DETARIEAE), A NEW SPECIES FROM AMAZONIAN ECUADOR

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ABSTRACT

Browneopsis puyensis D.A. Neill & Asanza (Leguminosae: Caesalpinioideae: Detarieae), a new species known only from a single adult tree in a riverside urban park in the city of Puyo, the capital of Pastaza province at the western edge of the Amazon basin in Ecuador, is described and illustrated. The new species is a large canopy tree attaining 30 m, and the ramiflorous inflorescences are borne on large horizontal limbs. The white, nocturnal flowers are protogynous, a feature not reported previously for *Browneopsis* or related genera in the tribe Detarieae.

RESUMEN

Se describe y se ilustra **Browneopsis puyensis** D.A. Neill & Asanza (Leguminosae: Caesalpinioideae: Detarieae), una especie nueva conocida únicamente de un solo árbol adulto en un parque urbano ribereño en la ciudad de Puyo, la capital de la provincia de Pastaza en la margen occidental de la llanura amazónica de Ecuador. La especie nueva es un árbol grande de 30 m de altura, y las inflorescencias ramifloras salen de las ramas principales horizontales. Las flores blancas y nocturnas son protóginas, una característica no reportada previamente para *Browneopsis* o para géneros afines de la tribu Detarieae.

The genus *Browneopsis* Huber comprises seven known species from the western Amazon basin in Ecuador, Peru and western Brazil, the Chocó biogeographic region along the Pacfiic coast of Colombia and Ecuador, including the Magdalena valley of Colombia, and the Darién region of eastern Panama (Klitgaard 1991; Lewis et al. 2005; Silverstone-Sopkin 2010). *Browneopsis* is separated from the related genus *Brownea* Jacq. by several floral characteristics: *Browneopsis* lacks bracteoles and some or all of the petals are reduced in size, or entirely lacking, and the floral parts of *Browneopsis* are white or cream whereas those of *Brownea* are red, orange, pink (yellow in one recently described species, *Brownea jaramilloi* A.J. Pérez & Klitg.; Pérez et al. 2012). The floral features are correlated with differences in pollinators: the red, diurnal flowers of *Brownea* pollinated by hummingbirds and the white, nocturnal flowers of *Browneopsis* pollinated by bats or moths. A molecular phylogeny using chloroplast trnL intron sequences (Bruneau et al. 2001) suggested that *Browneopsis* and *Brownea* are not monophyletic, but that more comprehensive sampling is needed (Lewis et al. 2005).

Browneopsis ucayalina Huber is locally common in Amazonian Ecuador and Peru, with up to 47 individuals recorded in one-hectare forest inventory plots (data from unpublished appendix to ter Steege et al. 2013), but most of the other species are evidently quite rare, and several are listed as Critically Endangered (CR) or Endangered (EN) according to the IUCN Red List categories (IUCN 2001): *B sanintiae* Silverst. in Colombia and *B. macrofoliolata* Klitg. and *B. disepala* (Little) Klitg. in coastal Ecuador (Silverstone-Sopkin 2010; Neill 2011). We describe herein an additional species of *Browneopsis* from Amazonian Ecuador that, based on available evidence, is also rare and endangered.

Browneopsis puyensis D.A. Neill & Asanza, sp. nov. (**Figs.1, 2**). TYPE. ECUADOR: PASTAZA PROVINCE: Pastaza cantón, Puyo, River walk along the Río Puyo, the "Paseo Turístico" between the campus of the Universidad Estatal Amazónica and the "malecón" near the city center, 1°28'10"S 77°59'40"W, 950 m, 26 Mar 2013 (fl.), *David Neill, Javier Robayo & Mercedes Asanza 17614* (HOLOTYPE: ECUAMZ: ISOTYPES: K, MO, NY, QCNE).

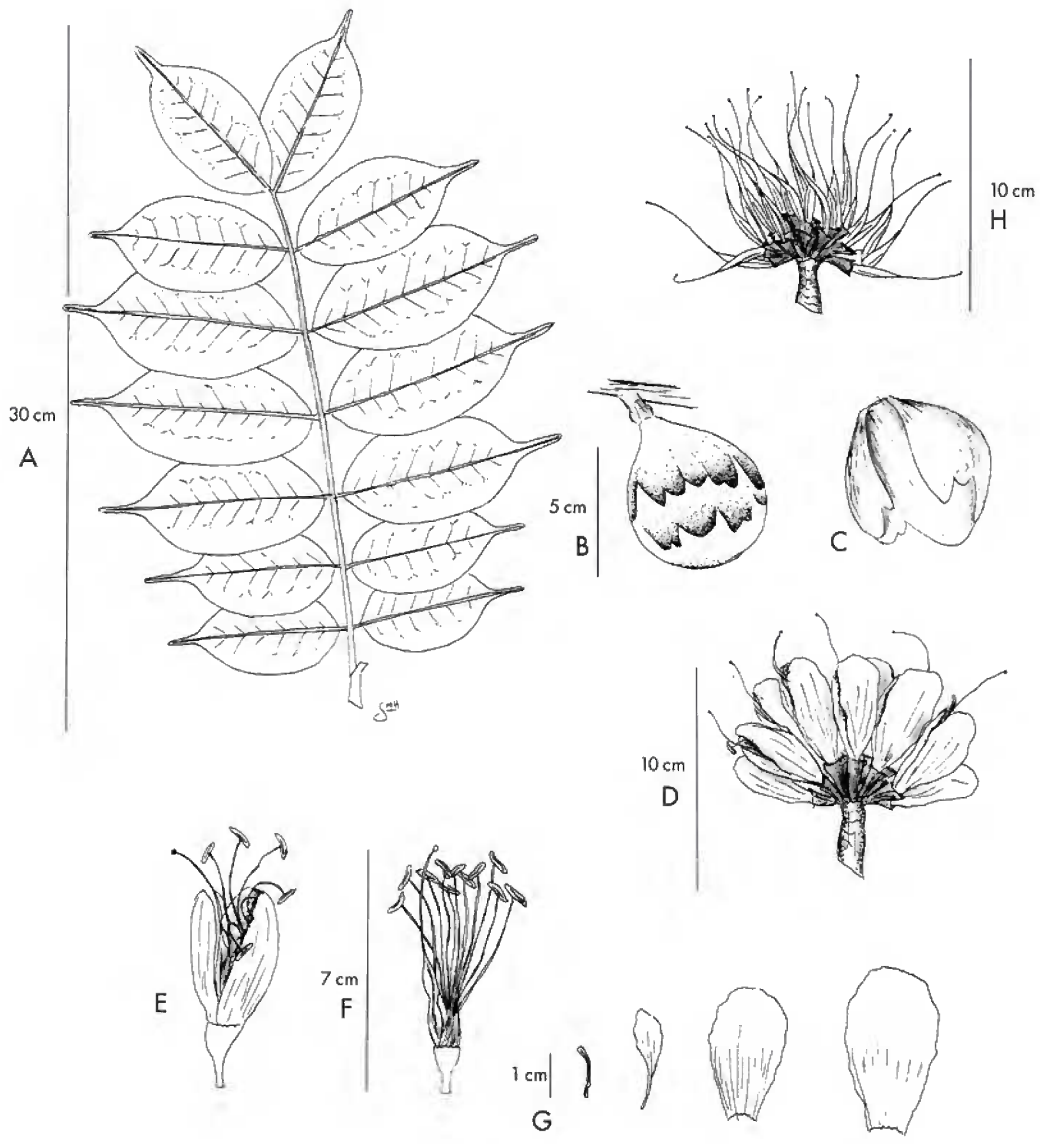

Fig. 1. ***Browneopsis puyensis*** **D.A. Neill & Asanza. A. Leaf. B. Inflorescence bud. C. Inflorescence bract. D. Protogynous inflorescence in the female phase. E. Open flower with sepals. F. Flower after the sepals are shed. G. Sepals, showing range of sizes. H. Inflorescence with pistils after sepals and stamens have been shed; no fruit set was observed after this stage of flowering. Drawn from the type collection,** ***Neill et al. 17614.***

This species differs from other taxa of *Browneopsis* in the combination of characters including its large stature, a 30-m canopy-level tree; the number of leaflets, with 7(–8) pairs of leaflets with long-acuminate apices; inflorescence position, with inflorescences ramiflorous, borne on large horizontal limbs, not cauliflorous, axillary or terminal; and presence of only one vestigial, minute petal, or petals entirely absent.

Tree attaining 30 m, with trunk 66 cm diameter. Bark densely lenticellate, gray. Wood very hard and heavy. Crown cylindrical with large horizontal limbs. Young branchlets, petioles and adaxial leaf surfaces densely pubescent with light brown simple hairs, all parts becoming glabrescent with age. Leaves alternate, paripinnate, with 7(–8) pairs of leaflets; leaflets opposite to subopposite. Petiole + rachis 20–27 cm. Blades coriaceous,

Fig. 2. Photograph of protogynous inflorescence of *Browneopsis puyensis*, in the female phase, shortly after anthesis in late afternoon before the first night of flowering; the styles are exserted and beginning to straighten out, but the staminal filaments remain curled and covered by the cucullate sepals until the following evening.

glaucous with a waxy coat on adaxial surface, becoming glabrescent with age. Proximal pair of leaflets shorter than the 6(–7) distal pairs, broadly ovate, 4.5–6 cm × 1.8–3.2 cm, base rounded and mostly asymmetrical, apex long-acuminate. Distal leaflets elliptic to narrowly lanceolate, 7–12 × 3–4 cm, base rounded and asymmetrical or nearly symmetrical, apex long-acuminate. Inflorescences ramiflorous, borne on short shoots emerging from large horizontal limbs, or on medium-diameter branches but not on small distal leafy branches, usually erect but sometimes descending. Inflorescence bud globose, 6–8 cm in diameter, enclosed by 4–6 inflorescence bracts. Bracts cucullate, 5–6 cm × 4–5 cm, apex rounded, base truncate, white, with dense light brown pubescence on abaxial surface; the adaxial surface glabrous or with a few scattered simple brown hairs. Flowers ca. 30–40 per capitulum, sessile, bracteoles absent; hypanthium 12–15 mm × 5–6 mm, glabrous; sepals 3–4, with 2 larger sepals and 1–2 smaller ones, larger sepals 35–40 × 15–18 mm, spathulate, cucullate, rounded at apex, white with light brown pubescence on lower third of abaxial surface, smaller sepals 20–25 × 3–4 mm, narrowly spathulate, apex acute, petals 0–1, vestigial, ca. 2–3 × 1–2 mm, subulate; stamens 14–16, basally connate,

tube + free filaments 55–65 mm, filaments fused in basal 15–20 mm, tube open on one side, white, glabrous, anthers versatile, ca. 6 × 1.5 mm; ovary + style 65–70 mm, ovary 15–20 × 3–4 mm, densely villous with light brown hairs; style and stigma glabrous, stigma subcapitate. Fruit not seen.

Browneopsis puyensis is a large, canopy-level tree attaining 30 m in height, whereas most other species of *Browneopsis* are smaller understory or subcanopy trees in humid lowland forests (Klitgaard 1991). An exception may be *Browneopsis excelsa* Pittier in the Darién region of Panama, which has been described as a large 30-m tree (Schery 1951). With its 7(–8) pairs of leaflets, *B. puyensis* differs from its congeners in numbers of leaflets: 2–3 pairs in *B. excelsa, B. macrofoliolata* and *B. peruviana* (J.F. Macbr.) Klitg., 2–4 pairs in *B. cauliflora* (Poepp. & Endl.) Huber, 4–6 pairs in *B. sanintiae*, and 8–11 pairs in *B. disepala*. The leaves of *B. puyensis* are remarkably similar to those of *Brownea grandiceps* Jacq. in the size, shape and number of leaflets. The latter species occurs in Amazonian Ecuador, but at lower elevations and farther east than *B. puyensis*, and is a small understory tree with terminal inflorescences and red flowers; in sterile condition, juvenile plants of these two species in different genera may be quite indistinguishable. The position of the inflorescence in *B. puyensis*, ramiflorous and usually erect on large principal branches, is unique among its congeners: *B. ucayalensis* and *B. cauliflora* have cauliflorous inflorescences along the trunk, and the remaining species have terminal, subterminal or axillary inforescence on small branches.

Distribution and ecology.—*Browneopsis puyensis* is known only from a single large adult individual, growing in the middle of a brick sidewalk constructed around the base of the tree in recent years, along the "Paseo Turístico" on the banks of the Puyo River in the city of Puyo, the capital of Pastaza province, Ecuador, at 950 m elevation. The site is about 100 m from the entrance to the campus of the Universidad Estatal Amazónica, within a small and narrow remnant of primary forest trees along the river. Beside the adult tree is a 4 m juvenile treelet of the same species, and several small saplings less than 1 m tall are in the forest understory near the adult. The original forest in the area around Puyo has almost entirely been deforested and the land converted to pastures, sugar cane fields and urban-suburban development, and a search for additional adult trees of this species was not successful. Mr. Rafael Sancho, the former mayor of Puyo, described to the authors his initiative to protect the riverine forest during his mayoral tenure, 1978–1982; at that time, a larger area of relatively intact forest was still extant along the Puyo River, but subsequent municipal administrations did not continue the conservation efforts and most of the remaining primary forest was lost during the following decades. The present brick walkway, the "Paseo Turístico Río Puyo", was built by the Ministry of Tourism in 2010 and the walkway is a favorite site for residents and visitors to stroll, jog and sometimes to swim in the river; besides *Browneopsis puyensis*, several other rare and locally endemic tree species occur in the narrow belt along the riverine park within the urban core of Puyo. The site is 20 km east of the eastern base of the Andes with a wet aseasonal climate; annual precipitation in Puyo is about 4000 mm; in the recently completed vegetation map of Ecuador (Ministerio del Ambiente 2012), the original vegetation of the area is designated "Bosque siempreverde piemontano del Norte de la Cordillera de los Andes". Growth rates of this species are not known, but judging from the very dense heavy wood, evident in the branch wood, and the slow growth rates observed by the authors in other genera and species of Detarieae in Amazonia, the 30-m, 66-cm diameter individual of *B. puyensis* is probably several centuries old and predates the late 19th-century founding of the city of Puyo by a wide margin.

Etymology.—The specific epithet refers to the city of Puyo, the capital of Pastaza province, where the only known adult and juvenile individuals are known. The city's name is derived from the word "puyu" in Kichwa, the language of the indigenous people of the region, and signifies "mist," a term which aptly describes the per-humid climate of the site.

Phenology and protogyny.—The large adult individual of *Browneopsis puyensis* flowered abundantly for about a month each year it was observed, during late March to late April in 2013 and again in 2014. No fruits were set in either year; however, the caretakers of the urban park along the Puyo River informed the authors that in some past years, fruits matured with viable seeds during August. The presence of a few juvenile individuals near the base of the large flowering tree suggests that seed production has indeed occurred. No addi-

tional adult trees are known, and if the species is mostly self-incompatible but with occasional fruit set from geitonogamous pollination, a low incidence of mature seed production could be expected.

The flowers of *Browneopsis puyensis* are protogynous at the level of the inflorescence. We observed that the inflorescence buds open in late afternoon, and during the first night of anthesis, the styles are fully exserted and straight, but the stamens remain curled up within the "pockets" of the two large cucullate sepals (Fig. 2.). On subsequent nights, the sepals fall away and the staminal filaments are fully extended. The female phase of the protogynous inflorescences may sometimes last more than one night before the sepals dehisce and the staminal filaments unfurl completely. Protogyny in inflorescences of *Browneopsis disepala* from coastal Ecuador was previously described by Knudsen and Klitgaard (1998) as part of an extensive study of the pollination biology and floral scent of that species. At night, we observed the inflorescences with the aid of binoculars, looking for floral visitors, and detected hawkmoths in the vicinity of the inflorescences but were not able to confirm that they actually visited the flowers.

IUCN Red List Category.—Browneopsis puyensis is known at present from a single adult individual with flowers that may be mostly, though perhaps not completely, self-incompatible. Like most taxa in the tribe Detarieae, the species is probably slow-growing and confined to primary forest under natural conditions. The region around the city of Puyo where this single tree was found has been largely deforested in recent decades and no other fragments of primary forest have been found with this species present. In lieu of a comprehensive search and a population study, it is logical to place the new species in the highest threat category of the IUCN Red List system (IUCN 2001): Critically Endangered (CR). Given the easy accessibility of the one known flowering individual, it will be monitored in future years for possible fruit set, and vegetative propagation *ex situ* of this species will be carried out by the Universidad Estatal Amazónica, following the guidelines of the Global Strategy for Plant Conservation (http://www.cbd.int/gspc/strategy.shtml) adopted by the nations that are parties to the Convention on Biological Diversity.

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